

LISTING OF THE CLAIMS

► The following listing of claims replaces all prior listing of claims in the application:

Claim 1 (previously presented): An optical device comprising:

a first optical element;

a support member defining an aperture for receiving said first optical element, said support member having a pair of openings diametrically opposed relative to said first optical element in said opening, each of said pair of openings having a passage from an outside surface of said support member to said aperture; and

an adhesive disposed within said pair of openings, said adhesive adhering to said first optical element and to an inside surface of said pair of openings, said adhesive having a viscosity sufficiently high that said adhesive, in an uncured state, does not substantially wick between said first optical element and said support member.

Claim 2 (previously presented): The optical device of Claim 1 wherein said adhesive is limited to a volume bounded by said pair of openings and a surface of said first optical element.

Claim 3 (original): The optical device of Claim 1 wherein said adhesive is an epoxy with a filler.

Claim 4 (original): The optical device of Claim 1 wherein said adhesive is an epoxy with a filler having a concentration of at least 68%, said filler being amorphous silica.

Claim 5 (original): The optical device of Claim 1 wherein said adhesive includes a filler of amorphous silica having an average particle size less than or equal to 10 micrometers.

Claim 6 (original): The optical device of Claim 1 wherein said adhesive has no more than 0.1 % shrinkage during curing.

Claim 7 (original): The optical device of Claim 1 wherein said adhesive has no more than 100 ppm per degree Celsius of thermal expansion over a temperature range from -40 degrees Celsius to +85 degrees Celsius.

Claim 8 (previously presented): The optical device of Claim 1 wherein said first optical element is selected from a group including a collimator, an actuator, an attenuator, and an optical filter.

Claim 9 (cancelled)

Claim 10 (previously presented): The optical device of Claim 1 wherein each of said pair of openings has a longitudinal axis parallel to a longitudinal axis of said first optical element.

Claim 11 (previously presented): The optical device of Claim 1 further including:

- a second optical element;

- a second aperture defined by said support member, said support member having a second pair of openings diametrically opposed relative to said second optical element in said second aperture, said second pair of openings having a passage from an outside surface of said support member to said second aperture, each of said second pair of openings having a longitudinal axis parallel to a longitudinal axis of said second optical element; and

- said adhesive disposed within said second pair of openings, said adhesive adhering to said second optical element and to an inside surface of said second pair of openings, said adhesive having a viscosity sufficiently high that said adhesive, in an uncured state, does not substantially wick between said second optical element and said support member.

Claim 12 (previously presented): An optical device comprising:

a first optical member;

a support member defining an opening for receiving said first member, said second member having a pair of slots diametrically opposed relative to said first member in said opening, each of said pair of slots having a passage from an outside surface of said second member to said opening, each of said pair of slots having a longitudinal axis parallel to a longitudinal axis of said first member; and

an adhesive disposed within said pair of slots, said adhesive adhering to said first member and to an inside surface of said pair of slots, said adhesive having a viscosity sufficiently high that said adhesive, in an uncured state, does not substantially wick between said first member and said second member, said adhesive including an epoxy and a filler, said filler being amorphous silica, said filler having a concentration of at least 68 percent.

Claim 13 (original): An optical device in which a plurality of optical elements are adhered to a support member, said optical device for acting on optical signals, said optical device comprising:

a first collimator;

a second collimator;

an actuator;

a housing defining two openings for receiving said first and second collimators, said housing defining an actuator opening for receiving said actuator, said actuator opening substantially between about said two openings, said first collimator positioned such that a light beam is directed into said second collimator through at least one mirror, said actuator positioned such that said actuator interacts with said light beam when said actuator is actuated, said housing having a pair of slots for each of said two openings and said actuator opening, said pair of slots diametrically opposed relative to each of said two openings and said actuator opening, each of said pair of slots having a longitudinal axis parallel to a corresponding longitudinal axis of said first and second collimators and said actuator; and

an adhesive disposed within each of said pair of slots, said adhesive adhering to a corresponding said first and second collimator and to an inside surface of each of said pair of slots, said adhesive having a viscosity sufficiently high that said adhesive, in an uncured state, does not substantially wick between said first and second collimators and said housing and between said actuator and said housing.

Claim 14 (original): The optical device of Claim 13 wherein said adhesive is limited to a volume bounded by said pair of slots and a surface of said first member.

Claim 15 (original): The optical device of Claim 13 wherein said adhesive is an epoxy with a filler, said filler being amorphous silica.

Claim 16 (original): The optical device of Claim 13 wherein said adhesive includes a filler of amorphous silica having an average particle size less than or equal to 10 micrometers.

Claim 17 (original): The optical device of Claim 13 wherein said adhesive is an epoxy with a filler having a concentration of at least 68%, said filler being amorphous silica.

Claim 18 (original): The optical device of Claim 13 wherein said actuator includes an attenuator that interacts with an optical path from said first collimator to said second collimator.

Claim 19 (original): The optical device of Claim 13 further including:
a third collimator;
a third collimator opening for receiving said third collimator, said housing having a pair of third collimator slots for said third collimator opening, said pair of third collimator slots diametrically opposed relative to said third collimator opening, said pair of third collimator slots having a longitudinal axis parallel to a corresponding longitudinal axis of said third collimator; and

said adhesive disposed within said pair of third collimator slots, said adhesive adhering to said third collimator and to an inside surface of said pair of third collimator slots, said adhesive having a viscosity sufficiently high that said adhesive, in an uncured state, does not substantially wick between said third collimator and said housing.

Claim 20 (original): The optical device of Claim 19 wherein said actuator includes a mirror which, when interjected into an optical path from said first collimator to said third collimator by said actuator, said optical path is redirected from said first collimator to said second collimator.

Claim 21 (original): The optical device of Claim 19 wherein said actuator includes a mirror which, when interjected into a first optical path from said first collimator to said third collimator by said actuator, said first optical path is interrupted and a second optical path is formed from said second collimator to said third collimator.

Claim 22 (cancelled)

Claim 23 (cancelled)

Claim 24 (previously presented): The optical device of Claim 39 wherein said adhesive includes a filler having an average particle size less than or equal to 10 micrometers.

Claim 25 (original): An optical device in which a first element is adhered to a second element, said optical device comprising:

an optical element;

a means for supporting said optical element; and

a means for adhering said optical element to said means for supporting.

Claim 26 (original): The optical device of Claim 25 wherein said means for adhering includes an adhesive in contact with said optical element and said means for supporting such that said adhesive bridges an area adjacent to where said optical element is proximal said means for supporting.

Claim 27 (currently amended): A method for forming an optical device ~~by adhering a first element to a second element such that displacement between the first and second elements is limited,~~ said method comprising the steps of:

a) ~~aligning a first~~ an optical member relative to a ~~second support~~ member, ~~said second member adapted to receive said first member,~~ said second support member defining a ~~first opening and a second opening,~~ said support member receiving said optical member within said first opening, ~~each of said first opening and,~~ said support member defining a second opening intersecting said first opening, ~~said second opening defining a volume,~~ an inside surface, said optical member defining a chord collinear with a line parallel to a longitudinal axis of said second opening, ~~and a line parallel to a longitudinal axis of each of said pair of openings,~~ each of said first opening line and said second opening line intersecting said optical element;

b) applying an adhesive to each of said first opening and said second opening, said adhesive adhering to said first optical member, ~~said first opening inside surface,~~ and said second opening inside surface, said adhesive having a viscosity sufficiently high that said adhesive, in an uncured state, does not substantially wick between said first optical member and said ~~second support~~ member; and

c) curing said adhesive.

Claim 28 (cancelled)

Claim 29 (currently amended): The method of Claim 27 wherein each of said first opening and said second opening has a longitudinal axis substantially parallel to a longitudinal axis of said ~~first~~ optical member.

Claim 30 (original): The method of Claim 27 wherein said adhesive includes a filler of amorphous silica.

Claim 31 (previously presented): The method of Claim 27 wherein said adhesive includes a filler of amorphous silica having an average particle size less than or equal to 10 micrometers.

Claim 32 (currently amended): A method for forming an optical device by ~~adhering a first element to a second element~~ having a support member and an optical element, the support member having a first member and a second member cooperating to receive the optical element therebetween, a pair of seams being defined between the first member and the second member, the pair of seams providing access to the optical element, the optical member having a chord and a line collinear with the cord that passes through at least one of the pair of seams ~~such that displacement between the first and second elements is limited~~, said method comprising the steps of:

- a) aligning an optical element relative to a support member;
- b) applying an adhesive to ~~a~~ the optical member through the pair of seams proximal said in the support member joining optical element, each one of said pair of seams oriented on opposing sides of said optical element, said adhesive having a high viscosity such that it does not flow between said optical element and said support member; and
- c) curing said adhesive.

Claim 33 (original): The method of Claim 32 wherein said support member has a pair of slots oriented on opposing sides of said optical element, said pair of slots adapted to receive said adhesive.

Claim 34 (original): The method of Claim 32 wherein said adhesive has a filler and said filler includes amorphous silica.

Claim 35 (original): The method of Claim 32 wherein said adhesive includes a filler of amorphous silica having an average particle size less than or equal to 10 micrometers.

Claim 36 (original): The method of Claim 32 wherein said adhesive has a filler and said filler includes amorphous silica of at least 68% concentration.

Claim 37 (original): The optical device of Claim 12 wherein said filler has an average particle size less than or equal to 10 micrometers.

Claim 38 (currently amended): An optical device comprising:
a optical element;
a housing defining an aperture ~~for receiving said optical element~~, said housing defining a ~~pair of~~ through-openings extending from an outside surface of said ~~support housing~~ into said aperture, ~~each of said pair of~~ through-openings defining an inside surface and a line parallel to a longitudinal axis of each of said ~~pair of~~ through-openings, ~~each said line of said pair of through openings intersecting said optical element~~, a line parallel to said longitudinal axis being collinear with a chord defined by said optical element; and
an adhesive disposed within ~~each of said pair of~~ through-openings, said adhesive adhering to said optical element and to said inside surface of ~~each of said pair of~~ through-openings, said adhesive having a viscosity sufficiently high that said adhesive, in an uncured state, does not substantially wick between said optical element and said housing.

Claim 39 (currently amended): An optical device comprising:
an optical element;
a support member having a first surface in physical contact with said optical element, said first surface defining a through-opening extending to an outside surface of said support member, said through-opening defining at least one inner surface

substantially perpendicular to said first surface, a line collinear with a chord of said optical element that is substantially perpendicular to said first surface ~~said through-opening oriented such that a line parallel to a longitudinal axis of said through-opening intersects said optical element extending into said through-opening;~~ and

an adhesive disposed in said through-opening, said adhesive in contact with said optical element and with said at least one inner surface, said adhesive having a viscosity sufficiently high that said adhesive, in an uncured state, does not substantially wick between said optical element and said support member.

Claim 40 (cancelled)